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(54) IMPROVEMENTS IN AND RELATING TO ELECTRICAL OVERLOAD RESPONSIVE CIRCUITS

(71) I, THOMAS MOORE, a citizen of the United States of America of 231, Fay Drive, Indiatlantic, Florida 32901, United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to electrical overload responsive circuits.

The present invention provides an electrical overload responsive circuit, comprising a pair of inlet terminals for connection to an electric power supply and a pair of outlet terminals for connection to an electrical appliance to supply said appliance with current from said power supply, a first thermally responsive switch for sensing the flow of current from one said inlet terminal to a corresponding said outlet terminal, and operative in response to the current reaching a first predetermined excess current value to activate a first alarm, and a second thermally responsive switch for sensing the flow of current from a said inlet terminal to a corresponding said outlet terminal and operative in response to the current reaching a second predetermined excess current value, greater than said first predetermined value, to interrupt the flow of current to said appliance and activate a second alarm.

The present invention further provides a circuit for indicating an electrical motor overload condition, comprising a housing, an electrical thermally responsive switch mounted in said housing, first and second alarm means mounted on said housing, circuit means in said housing being connectable to an electric current source of predetermined voltage and arranged to connect said motor in series with the thermal element of the thermally responsive switch, said switch which is normally open being arranged to close when the current passing through the thermal element to the motor exceeds a first predetermined excess current value, further circuit means connected to said switch and said first alarm means whereby when said switch is closed, electric energising current is applied to said first alarm means through said further circuit means, and thermal switch means responsive to a second predetermined excess current value of motor current, greater than the first predetermined value, to interrupt current to the motor and to activate the second alarm means.

An electrical overload responsive circuit or device, for use with an electric motor, embodying the present invention will now be described by way of example with reference to the accompanying diagrammatic drawings in which:

Figure 1 is an electrical diagram of the circuit or device;

Figure 2 shows the front of a receptacle designed for ordinary household use;

Figure 3 is a sectional view taken on lines 3—3 of Figure 2 with the plate member shown in dot-dash lines;

Figure 4 is a perspective view of the front plate of the device shown in Figures 2 and 3;

Figure 5 is a side elevational view of the device modified to be an adapter for an ordinary household outlet; and

Figure 6 is a perspective view of the adapter shown in Figure 5.

Referring to Figure 1, the receptacle which is depicted diagrammatically by the dot-dash lines is designated by reference numeral 10. Within the receptacle is a circuit means 11 which comprises conductive members such as insulated copper wires well known to the art. The circuit means 11 is connectable on one side to an electrical power source 12 such as, for example, ordinary 110 AC house current, and on the other side it is connectable to a motor 14 which may be, for example, a conventional one-third horsepower AC induction motor. Mounted within the receptacle 10 are three electrical alarms or indicia means comprised of a red lamp alarm 15, a yellow lamp alarm 16, and a green lamp alarm 17. Also mounted within the receptacle 10 are a pair of quick acting

electrical thermally responsive switches 20 and 21. Switch 20 includes the bimetallic member 22 which, when heated by the passage of electrical current therethrough, moves to bring contact points 24 and 25 together. In switch 21 there are a pair of bimetallic members 26 and 27 which are normally in electrical contact through a metallic stud 30 threaded through a metallic member 26, but which are moved apart by the passage of sufficient current therethrough whereby the stud 30 no longer contacts the bimetallic member 27.

The circuit means 11 comprises a first conductive member 31 which leads from the connection to the electrical power source 12 to make electrical contact with the bimetallic member 24. A second conductive member 32 connects electrically to the opposite end of the bimetallic member 24 and leads therefrom to the connection to the motor 14. A third conductive member 33 leads from the connection to the electrical power source 12 to make electrical contact with the bimetallic member 27. A fourth conductive member 34 conductively connects to the bimetallic member 26 and leads to a connection to the motor 14.

A further circuit for the green lamp 17 comprises a fifth conductive member 35 which leads from the second conductive member 32 to lamp 17 and a sixth conductive member 36 which leads from the opposite electrical side of lamp 17 to complete the circuit with the fourth conductive member 34.

A still further circuit for the yellow lamp 16 comprises a seventh conductive member 37 which leads from the fourth conductive member 34 (via the sixth conductive member 36) to lamp 16 and an eighth conductive member 38 which leads from the opposite electrical side of lamp 16 to a portion 41 of switch 20 which is conductive to contact 25.

The red lamp 15 connects on one side to the fourth conductive member 34 through a ninth conductive member 39 and on its other side connects to the third conductive member 33 through a tenth conductive member 40.

Under normal operating conditions with motor 14 operating within its power rating, only the green lamp 17 is lit. However, if the current is increased sufficiently beyond that rated for motor 14 to raise the temperature of the bimetallic member 22 sufficiently, contact is made between contact points 24 and 25 which places voltage across the lamp 16 to show this condition to exist. It will be understood that this does not disconnect the motor 14 and both lamps 17 and 16 are lighted to indicate the overload condition. Although the bimetallic member 22 can heat up somewhat rapidly so as to bring contact points 24 and 25 into contact, the cooling off process is considerably slower and thus even for a period of time after an overload is no longer applied to the motor 14, the lamp 16 remains in a lighted condition as an indication that the motor 14 has undergone an overload condition.

If the overload condition in motor 14 is more sustained, the switch 21 is heated sufficiently so that the bimetallic elements 26 and 27 move apart whereby stud 30 is no longer in contact with the bimetallic member 27. When this occurs, the red lamp 15 is placed in series with the motor 14 and, because it has a much higher resistance than the motor 14, almost all of the available voltage is disposed across the lamp 15 and practically none across the motor 14, or therefore also across the second and fourth conductive members 32 and 34. In consequence, the yellow lamp 16 and the green lamp 17 are, for all practical purposes, turned off. In this condition, the motor 14 is effectively protected from harmful voltage; however, after a period of time the switch 21 cools sufficiently so that voltage is restored to the motor 14, the red lamp 15 is turned off and the yellow and green lamp 16 and 17 are again lighted. Assuming that the condition of the motor remains unchanged, in a very short period—at most a very few seconds and usually a split second—switch 21 is again opened, red lamp 15 turns on and yellow and green lamps 16 and 17 blink off. The greater the overload condition, the shorter the interval. The motor 14 is protected since overheating occurs in the switch 21 and causes it to open before harmful overheating can occur in the motor 14. However, the blinking of the lamps, with the intermittent noise of the motor which thus occurs is much more likely to attract attention than would be the case if the circuit were broken and the switch 21 retained in an open position until reset by hand. If desired, insulation can be applied to the switch 21 to delay its time for closing due to cooling.

The lamps 15, 16 and 17 are preferably low-power lamps of sturdy construction such as used for example for circuit testers. The receptacle 10 is normally of Bakelite (Registered Trade Mark) or other insulating plastics material which may be shaped with protrusions as shown in Figure 3 to clamp the lamps 15, 16 and 17 in position over apertures 44, 45 and 46 which extend through a cover plate 47. The circuit means 11 and other wiring is carried in a parallelopiped member 50 which together with back plate 51 clamped thereon comprise the receptacle 10. The back plate 51 has a depression 52 with screw conducting leads 54 adapted to receive conductive means

from an electrical power source 12. An outlet member 55 is snugly received by the member 50 and extends through an opening 56 in the cover plate 47. The cover plate 47 is secured to the member 50 by a screw 57 or other appropriate securing means. The switch 21 is mounted on one side of the member 50 and the switch 20 (not shown in Figure 3) is mounted on the other side. It will, however, be understood that these components are well known to the art and a number of equivalent structures will readily occur to electrical engineers and others knowledgeable in the electrical field.

Where a particular outlet will be used only for a certain known electrical appliance such as, say, a washer or dryer, then either on initial installation or subsequently, an assembly such as shown in Figures 2, 3 and 4 may be installed. In the event that difficulties should occur in a motor so connected, a warning will first appear by the lighting of lamp 16 behind the aperture 45 and, although the motor may still be operable, it should normally be checked for malfunction in the near future. Should a more serious condition occur whereby the motor is cut out by the opening of switch 21, the lamp 15 glows through the aperture 44 and the motor 14 is thus effectively cut off and protected from serious damage until its malfunction can be corrected. Upon seeing the light glow through aperture 44, or having his attention drawn thereto by occasional blinking of lamps 16 and 17 through apertures 45 and 46, the operator would normally withdraw the plug of the motor 14 from receptacle 55 and attend to the malfunction when possible.

Figures 5 and 6 show a variation of the receptacle 10 wherein the receptacle is in effect an adapter 60 having an outlet 61 and, extending from the back, a pair of plug prongs 62 which are adapted to be received by a normal household outlet. The adapter 61 is otherwise electrically identical in function and circuit with that shown and described with reference to Figure 1. The purpose, however, of the adapter 61 is to provide a convenient protector of the type described which can be used in conjunction with any ordinary household electrical outlet and serve for the user the same purpose as a more permanent installation of the type shown in Figures 2, 3 and 4.

If the malfunction which causes switch 21 to be opened and thus remove harmful voltage from motor 14 is something obvious, say an impediment to the movement of the agitation member in a washer or a tumbler in a dryer, upon removal of the impediment, the motor 14 when again plugged into an outlet member 55 or 61 will operate in its normal fashion with a green lamp, and permanent damage to the motor 14 has been prevented. If the problem lies in the bearings of the motor 14, the cost of replacing same is much less than the replacement of the entire motor 14. Thus with the device as disclosed herein, the major causes of motor failure are prevented and irreparable motor failure should be largely obviated.

WHAT I CLAIM IS:—

1. An electrical overload responsive circuit, comprising a pair of inlet terminals for connection to an electric power supply and a pair of outlet terminals for connection to an electrical appliance to supply said appliance with current from said power supply, a first thermally responsive switch for sensing the flow of current from one said inlet terminal to a corresponding said outlet terminal, and operative in response to the current reaching a first predetermined excess current value to activate a first alarm, and a second thermally responsive switch for sensing the flow of current from a said inlet terminal to a corresponding said outlet terminal and operative in response to the current reaching a second predetermined excess current value, greater than said first predetermined value, to interrupt the flow of current to said appliance and activate a second alarm.

2. A circuit according to Claim 1, wherein said first thermally responsive switch comprises a bimetallic element connected between the said one inlet terminal and the corresponding outlet terminal, and said first alarm comprises a lamp connected between the outlet terminal corresponding to the other said inlet terminal and an intermediate terminal, said intermediate terminal being so positioned that it is contacted by said bimetallic element as it bends in response to the current reaching said first predetermined value.

3. A circuit according to Claim 1 or to Claim 2, wherein said second thermally responsive switch comprises a bimetallic switch which opens in response to said current reaching and exceeding said second predetermined value, and wherein said second alarm comprises a lamp connected in parallel with said switch.

4. A circuit according to Claim 3, wherein said bimetallic switch comprises first and second bimetallic elements connected in series, said bimetallic elements being so arranged that they bend apart in opposite directions when the current therethrough reaches said second predetermined value.

5. A circuit according to any preceding claim, including a third alarm connected across said outlet terminals to indicate the absence or existence of a voltage across said outlet terminals.

6. A circuit for indicating an electrical

motor overload condition, comprising a housing, an electrical thermally responsive switch mounted in said housing, first and second alarm means mounted on said housing, circuit means in said housing being connectable to an electric current source of predetermined voltage and arranged to connect said motor in series with the thermal element of the thermally responsive switch, said switch which is normally open being arranged to close when the current passing through the thermal element to the motor exceeds a first predetermined excess current value, further circuit means connected to said switch and said first alarm means whereby when said switch is closed, electric energising current is applied to said first alarm means through said further circuit means, and thermal switch means responsive to a second predetermined excess current value of motor current, greater than the first predetermined value, to interrupt current to the motor and to actuate the second alarm means.

7. A circuit according to Claim 6, wherein said switch includes a bimetallic member as an actuating member.

8. A circuit according to Claim 6 or to Claim 7, wherein each said alarm means comprises a lamp.

9. A circuit according to any one of Claims 6 to 8 in which the second alarm means has a high electrical resistance compared with that of the motor, and the thermal switch means causes the second alarm means to be connected in series with the motor terminals when the motor current exceeds the second predetermined value.

10. An electrical fault responsive circuit substantially as herein described with reference to the accompanying drawing.

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1296220 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

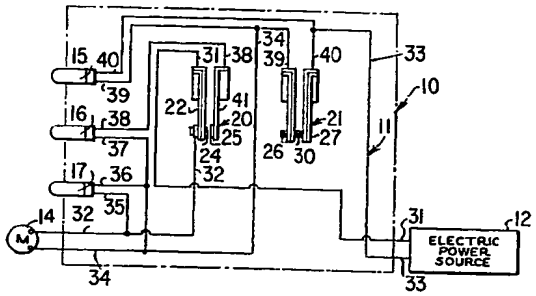

FIG. 1

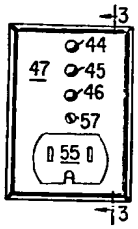

FIG. 2

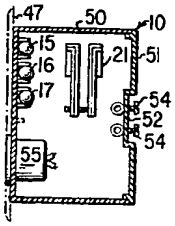

FIG. 3

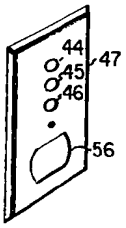

FIG. 4

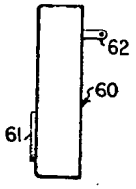

FIG. 5

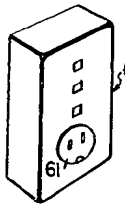

FIG. 6